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IS 2185-3 (1984): concrete masonry units, Part 3:
Autoclaved cellular Aerated concrete blocks [CED 53: Cement
Matrix Products]



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“Knowledge is such a treasure which cannot be stolen”

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IS : 2185 (Part 3) - 1984
(Superseding IS : 5482-1969)

Indian Standard

**SPECIFICATION FOR
CONCRETE MASONRY UNITS**

**PART 3 AUTOCLAVED CELLULAR (AERATED)
CONCRETE BLOCKS**

(First Revision)

First Reprint DECEMBER 1989

UDC 693.5:691.327.332-437

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard
SPECIFICATION FOR
CONCRETE MASONRY UNITS

**PART 3 AUTOCLAVED CELLULAR (AERATED)
CONCRETE BLOCKS**

(*First Revision*)

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(*Continued on page 2*)

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(Continued on page 15)

Indian Standard
SPECIFICATION FOR
CONCRETE MASONRY UNITS

**PART 3 AUTOCLAVED CELLULAR (AERATED)
CONCRETE BLOCKS**

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part 3) (First Revision) was adopted by the Indian Standards Institution on 30 April 1984, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 A series of National Standards on the cellular concrete has been formulated so as to provide standard products for the construction of buildings. Cellular concrete is a class of material which has been developed commercially abroad and is coming in vogue in this country also. This specification is intended for cellular (aerated) concrete blocks and its manufacture using the method of generation of gas by chemical action, the details of which are broadly indicated in Appendix A. The Sectional Committee responsible for the preparation of this standard has, however, no intention to freeze the method of manufacture to any one particular method.

0.3 Concrete masonry, already extensively used in building construction abroad, is likely to make very considerable headway in this country because of the many advantages, such as durability, strength and structural stability, fire resistance, insulation, and sound absorption it possesses. Concrete masonry construction is also economical because of the following aspects:

- a) The units are relatively large and true in size and shape. This ensures rapid construction so that more wall is laid per man-hour than in other types of wall construction;
- b) Fewer joints result in considerable saving in mortar as compared to normal masonry construction, and also in increasing the strength of the wall; and

- c) The true plane surfaces obtained obviate necessity of plaster for unimportant buildings situated in low rainfall areas; even when plaster is used for any reason, the quantity required for satisfactory coverage is significantly small.

0.3.1 Concrete masonry has an attractive appearance and is readily adaptable to any style of architecture. It lends itself to a wide variety of surface finishes for both exterior and interior walls. It may also be finished with cement plaster, gauged with lime or a plasticizer. Concrete masonry units provide a strong mechanical key, uniting the concrete masonry backing and the plaster finish in a strong permanent bond.

0.3.2 Autoclaved cellular (aerated) concrete blocks are used for both load bearing and non-load bearing internal walls, partition and panel walls, inner leaf of cavity walls or as backing to brick masonry and for external load-bearing walls as well as panel walls in steel or reinforced concrete frame construction when protected from weather by rendering or by some other efficient treatment.

0.4 This standard was first published in 1969 as "IS : 5482-1969 Specification for autoclaved cellular concrete blocks". This first revision is being issued as IS : 2185 (Part 3)-1984 under the modified title "Specification for concrete masonry units: Part 3 Autoclaved cellular (aerated) concrete blocks" and supersedes the former standard IS : 5482-1969. Part 1 of this standard Covers hollow and solid concrete blocks of normal weight and Part 2 Covers hollow and solid light weight concrete blocks. This modification in title is intended for facilitating the co-ordination of requirements of various types of concrete masonry units, covered under various Indian Standards.

0.4.1 This standard incorporates significant modifications specially with regard to materials and physical requirements such as dimensions, surface finish and texture. Requirement of fire resistance has been omitted from this revision and thermal conductivity has been retained. A clause on terminology has been added in this revision.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1969*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (revised).

1. SCOPE

1.1 This standard (Part 3) covers the requirements of autoclaved cellular (aerated) concrete blocks having density up to 1 000 kg. m³.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Autoclaved — Steam curing of concrete products, sandlime bricks, asbestos cement products, hydrous calcium silicate insulation products, or cement in an autoclave at maximum ambient temperatures generally between 170 and 215°C.

2.2 Block — A concrete masonry unit, any one of the external dimensions of which is greater than the corresponding dimension of a brick as specified in IS : 3952-1978*, and of such size and mass as to permit it to be handled by one man. Furthermore, to avoid confusion with slabs and panels, the height of the block shall not exceed either its length or six times its width.

2.3 Block Density — The density calculated by dividing the mass of a block by the overall volume, including holes or cavities and end recesses.

2.4 Drying Shrinkage — The difference between the length of specimen which has been immersed in water and then subsequently dried to constant length, all under specified conditions ; expressed as a percentage of the dry length of the specimen.

2.5 Gross Area — The total area occupied by a block on its bedding face, including areas of the cavities and end recesses.

2.6 Height — The vertical dimension of the exposed face of a block, excluding any tongue or other device designed to provide mechanical keying.

2.7 Length — The horizontal dimension of the exposed face of a block, excluding any tongue or other device designed to provide mechanical keying.

2.8 Width — The external dimension of a block at the bedding plane, measured at right angles to the length and height of the block.

*Specification for burnt clay hollow blocks for walls and partitions (first revision).

3. DIMENSIONS AND TOLERANCES

3.1 Concrete masonry building units shall be made in sizes and shapes to fit different construction needs. They include stretcher, corner, double corner or pier, jamb, header, bull nose, and partition block, and concrete floor units.

3.2 Concrete Block — Concrete block shall be referred to by its nominal dimensions. The term 'nominal' means that the dimension includes the thickness of the mortar joint. Actual dimensions shall be 10 mm short of the nominal dimensions (or 6 mm short in special cases where finer jointing is specified).

3.2.1 The nominal dimensions of the concrete block shall be as follows:

Length	400, 500 or 600 mm
Height	200, 250 or 300 mm
Width	100, 150, 200 or 250 mm

In addition, block shall be manufactured in half lengths of 200, 250 or 300 mm to correspond to the full lengths.

The nominal dimensions of the units are so designed that taking account of the thickness of mortar joints, they will produce wall lengths and heights which will conform to the principles of modular co-ordination.

3.2.2 Blocks of sizes other than those specified in 3.2.1 may also be used if so specified. In the case of special concrete masonry units such as jallie or screen wall block and ornamental block, the specified sizes may not necessarily apply.

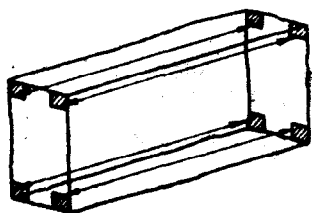
3.2.3 The maximum variation in the length of the units shall not be more than ± 5 mm and the maximum variation in the height and width of unit, not more than ± 3 mm (see Fig 1 for mode of measurement).

3.3 Subject to the tolerances specified in 3.2.3 and the provisions of 3.4 the faces of masonry units shall be flat and rectangular, opposite faces shall be parallel, and all arises shall be square. The bedding surfaces shall be at right angles to the faces of the blocks.

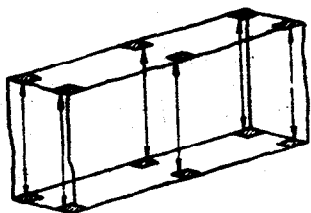
3.4 Blocks with Special Faces — Blocks with special faces shall be manufactured and supplied if so specified.

4. CLASSIFICATION

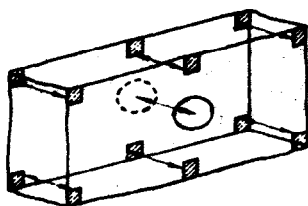
4.1 The autoclaved cellular concrete blocks shall be classified in two grades according to their compressive strengths as indicated in Table 1.



- (a) Four Positions for Checking Length of Whole Blocks and for Measuring Length of Cut Specimens



- (b) Six Positions for Checking Height of Whole Blocks



- (c) Seven Measurements of Thickness

FIG. 1 CHECKING AND MEASURING DIMENSIONS OF BLOCKS

TABLE 1 PHYSICAL PROPERTIES OF AUTOCLAVED CELLULAR CONCRETE BLOCKS

(Clauses 4.1, 8.3, 8.4, 8.5, 11.2, 11.3 and 11.4)

Sl. No.	DENSITY IN OVEN DRY CONDITION	COMPRESSIVE STRENGTH, <i>Min</i>		THERMAL CONDUCTIVITY IN AIR DRY CONDITION
		Grade 1	Grade 2	
(1)	(2)	(3)	(4)	(5)
	kg/m ³	N/mm ²	N/mm ²	W/m.k
i)	451 to 550	2.0	1.5	0.21
ii)	551 to 650	4.0	3.0	0.24
iii)	651 to 750	5.0	4.0	0.30
iv)	751 to 850	6.0	5.0	0.37
v)	851 to 1000	7.0	6.0	0.42

5. MATERIALS

5.1 Cement— Cement complying with any of the following Indian Standards may be used at the discretion of the manufacturer:

IS : 269-1976 Specification for ordinary and low heat Portland cement (*third revision*).

IS : 455-1976 Specification for Portland slag cement (*third revision*)

IS : 1489-1976 Specification for Portland pozzolana cement (*second revision*)

IS : 6909-1973 Specification for supersulphated cement

IS : 8041-1978 Specification for rapid hardening Portland cement (*first revision*)

IS : 8042-1978 Specification for white Portland cement (*first revision*)

IS : 8043-1978 Specification for hydrophobic Portland cement (*first revision*)

5.1.1 Use of fly ash conforming to IS : 3812-1981* may be permitted to a limit of 20 percent in cement conforming to IS : 269-1976†. However, it shall be ensured that blending of fly ash with cement is as intimate as possible, to achieve maximum uniformity.

5.2 Lime— The lime shall satisfy the requirements for Class C lime Specified in IS : 712-1973‡.

5.3 Aggregate— The aggregate used for the manufacture of cellular concrete blocks shall conform to the following requirements:

a) *Sand*— Conforming to IS : 383-1970§ except for the grading which may be made to suit the product and the silica content shall not be less than 80 percent.

b) *Fly Ash*— Conforming to IS : 3812-1981* with loss on ignition not more than 6 percent.

c) *Granulated Blast Furnace Slag*— Generally conforming to Notes 1 and 2 of 4.2 of IS : 455-1976¶ may be used.

*Specification for fly ash for use as pozzolana and admixture (*first revision*).

†Specification for ordinary and low heat Portland cement (*third revision*).

‡Specification for building limes (*second revision*).

§Specification for coarse and fine aggregates from natural sources for concrete (*second revision*).

¶Specification for Portland slag cement (*third revision*).

5.4 Water— The water used in the manufacture of concrete masonry units shall be free from matter harmful to concrete or reinforcement, or matter likely to cause efflorescence in the units and shall meet the requirements of IS : 456-1978*.

5.5 Additives or Admixtures— Additives or admixtures may be added either as additives to the cement during manufacture, or as admixtures to the concrete mix. Additives or admixtures used in the manufacture of concrete masonry units may be:

- a) accelerating, water-reducing and air-entraining admixtures conforming to IS : 9103-1979†.
- b) waterproofing agents conforming to IS : 2645-1975‡, and
- c) colouring pigments.

Where no Indian Standards apply, the additives or admixtures shall be shown by test or experience, to be not detrimental to the durability of the concrete.

6. MANUFACTURE

6.1 The aerated structure or the cells of the cellular concrete blocks shall be formed by generation of a gas by chemical action, with the mix, prior to hardening with the aid of suitable chemical foaming agents and mixing devices. The cells in the block shall be distributed evenly throughout its volume. Broad principles for the manufacture of the autoclaved cellular concrete blocks are given in Appendix A for guidance only.

7. SURFACE TEXTURE AND FINISH

7.1 Concrete masonry units can be given a variety of surface textures ranging from a very fine close texture to a coarse open texture by the proper selection, grading, and proportioning of aggregates at the time of manufacture. Textures may also be developed by treating the face of the units while still green by wire brushing or combing, by slightly eroding the surface by playing a fine spray of water upon it, and by splitting (split block). Colour may be introduced by incorporating non-fading mineral pigments in the facing concrete, or by applying a coloured cement grout or paint to the face of the units soon after they are removed from the moulds. Selected coloured aggregates may also be used in the facing and exposed by washing with water or dilute hydrochloric acid.

*Code of practice for plain and reinforced concrete (*third revision*).

†Specification for admixtures for concrete.

‡Specification for integral cement water proofing compounds (*first revision*).

7.2 Well made concrete masonry may not require plaster in case of unimportant buildings in low rainfall areas; two or three coats of a cement paint being sufficient to render it resistant to rain water. If, however, it is intended to plaster concrete masonry, the block shall have a sufficiently rough surface to afford a good key to the plaster. Waterproofing admixtures may be used for preparing the plaster.

8. PHYSICAL REQUIREMENTS

8.1 General — All units shall be sound and free of cracks or other defects which interfere with the proper placing of unit or impair the strength or performance of the construction. Minor chipping resulting from the customary methods of handling during delivery, shall not be deemed grounds for rejection.

8.1.1 Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall be free of chips, cracks, or other imperfections, except that if not more than 5 percent of a consignment contains slight cracks or small chippings not larger than 25 mm, this shall not be deemed grounds for rejection.

8.2 Dimensions — The overall dimensions of the units when measured as given in 3.2.3 shall be in accordance with 3.2.1 subject to the tolerances mentioned in 3.2.3.

8.3 Block Density — The block density shall conform to the requirements specified in Table 1 when tested in accordance with 9.1.

8.4 Compressive Strength — The minimum compressive strength, being the average of twelve units, shall be as prescribed in Table 1 when tested in accordance with 9.2.

8.5 Thermal Conductivity — The thermal conductivity shall not exceed the values specified in Table 1 when tested in accordance with 9.3.

8.6 Drying Shrinkage — The drying shrinkage shall be not more than 0.05 percent for Grade 1 blocks and 0.10 percent for Grade 2 blocks when tested in accordance with 9.4.

9. TESTS

9.1 Block Density — The block density shall be determined in the manner described in IS : 6441 (Part 1)-1972*.

*Methods of test for autoclaved cellular concrete products : Part 1 Determination of unit weight or bulk density and moisture content.

9.2 Compressive Strength — The compressive strength shall be determined in accordance with IS : 6441 (Part 5)-1972*.

9.3 Thermal Conductivity — The thermal conductivity shall be determined in accordance with IS : 3346-1980†.

9.4 Drying Shrinkage — The drying shrinkage shall be determined in the manner described in IS : 6441 (Part 2)-1972‡.

10. SAMPLING

10.1 Lot — In any consignment, all the blocks of the same size and from the same batch of manufacture shall be grouped together into a minimum number of groups of 10 000 blocks or less. Each such group shall constitute a lot.

10.2 From each lot a sample of 24 blocks shall be selected at random. In order to ensure randomness of selection, all the blocks in the lot may be arranged in a serial order. Starting from any random block every r th block may be selected till the requisite number is obtained, r being the integral part of $N/24$, where N is the lot size.

10.3 The required number of blocks shall be taken at regular intervals during the loading of the vehicle or the unloading of the vehicle depending on whether sample is to be taken before delivery or after delivery. When this is not practicable, the sample shall be taken from the stack in which case the required number of blocks shall be taken at random from across the top of the stacks, the sides accessible and from the interior of the stacks by opening trenches from the top.

10.4 The sample of blocks shall be marked for future identification of the consignment it represents. The blocks shall be kept under cover and protected from extreme conditions of temperature, relative humidity and wind until they are required for test. The tests shall be undertaken as soon as practicable after the sample has been taken.

10.5 Number of Tests

10.5.1 All the 24 blocks shall be checked for dimensions and inspected for visual defects.

*Methods of test for autoclaved cellular concrete products: Part 5 Determination of compressive strength.

†Methods for the determination of thermal conductivity of thermal insulation materials (two slab, guarded hot-plate method) (first revision).

‡Methods of test for autoclaved cellular concrete products: Part 2 Determination of drying shrinkage.

10.5.2 Out of the 24 blocks, 12 blocks shall be subjected to the test for compressive strength, 3 blocks to the test for density, 3 blocks to the test for thermal conductivity, and 3 blocks to the test for drying shrinkage. The remaining 3 blocks shall be reserved for re-test for drying shrinkage if a need arises.

11. CRITERIA FOR CONFORMITY

11.1 The number of blocks with dimensions outside the tolerance limit and or with visual defects, among those inspected, shall not be more than two.

11.2 For density, the mean value shall be within the range specified in Table 1.

11.3 For compressive strength, the mean value, say \bar{X} shall be determined. The test results shall be grouped into groups of 4 and individual values of ranges shall be determined and the average range \bar{R} calculated from these values and shall satisfy the following condition:

$$\bar{X} - 0.6 \bar{R} \geq \text{minimum value specified in Table 1.}$$

11.4 For thermal conductivity, the mean value shall be equal to or less than the value specified in Table 1.

11.5 For drying shrinkage, all the test specimens shall satisfy the requirements of the test. If one or more specimens fail to satisfy the requirements, the remaining 3 blocks shall be subjected to these tests. All these blocks shall satisfy the requirements.

12. MANUFACTURER'S CERTIFICATE

12.1 The manufacturer shall satisfy himself that the masonry units conform to the requirements of this specification and, if requested, shall supply a certificate to this effect to the purchaser or his representative.

13. INDEPENDENT TESTS

13.1 If the purchaser or his representative requires independent tests, the samples shall be taken before or immediately after delivery, at the option of the purchaser or his representative and the tests shall be carried out in accordance with this specification.

13.2 The manufacturer shall supply free of charge the units required for testing.

14. STORAGE

14.1 General requirements of storage of autoclaved cellular (aerated) concrete blocks shall be as described in IS : 4082-1977*.

15. MARKING

15.1 Each lot of concrete masonry units manufactured in accordance with this specification shall be suitably marked with the following information:

- a) The Identification of the manufacture;
- b) The grade and block density of the unit; and
- c) The month and year of manufacture.

15.1.1 Each block may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

A P P E N D I X A

(Clause 6.1)

MANUFACTURE OF AUTOCLAVED CELLULAR CONCRETE BLOCKS

A-1. Cellular concrete blocks involve the use of aerated concrete which is made by introducing air or other gas into a slurry composed of cement (see 5.1) or lime (see 5.2) and a siliceous filler (see 5.3) so that when the mixture sets hard after autoclaving, a uniform cellular structure is obtained. There are several ways in which air-cells or other voids may

*Recommendations on stacking and storage of construction materials at site (first revision).

be formed in the slurry as to result in a cellular structure after autoclaving, the principal ones of which are the following:

- a) By the formation of gas by chemical reaction within the mass during the liquid or plastic stage, in the same way as carbon dioxide is formed and used in aerating bread and baked products; and
- b) By introducing air from without, either by adding to the slurry in the mixer a preformed stable foam such as is used in fire-fighting or by incorporating air by whipping (with the aid of an air-entraining agent), in the manner in which egg-white may be whipped to a light cream or foam.

A-2. Suitable steam-curing is practically unavoidable in making cellular concrete blocks with cement as binder and the same is absolutely essential when lime is used. Generally, auto claving is done for about 14 to 18 hours at about 700 kPa and about 185°C, the heating and raising of pressure or cooling and lowering of pressure being generally gradual over a period of few hours.

A-3. Although simple in principle, the commercial production of autoclaved cellular concrete blocks is quite elaborate in practice. The sand or other siliceous material is generally ground in ballmills to their required degree of fineness which is usually comparable with the fineness of ordinary Portland cement.

(Continued from page 2)

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(Continued on page 16)

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